Sodium phase equilibrium line

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A phase equilibrium line (PEL) of sodium has been developed for temperatures from the triple point ($T_t = 371$ K) to the critical point ($T_c = 2503.71$ K). The equations describing the vapor and liquid branches of the saturation line (SL) are consistent with each other both in coefficients and in exponents, and the average diameter of the coexistence curve in a wide vicinity of the critical point satisfies the screening theory. Within the framework of the proposed PEL model, the vapor branch of the SL is described based on the Clapeyron-Clausius equation, which uses not the heat of vaporization, r, but the "apparent" heat of vaporization, $r^* = r/(1-\rho^-/\rho^+)$, where ρ^- and ρ^+ are the densities of saturated vapor and saturated liquid, respectively. The phase equilibrium line model was tested using the example of describing data on ρ^-, ρ^+ and the saturated vapor pressure of methane, ethane, perfluorooctane, and sulfur hexafluoride [1, 2]. The proposed approach is used to ensure consistency between the thermal and caloric characteristics of sodium in the vicinity of the triple point. Inconsistencies between known data on the heat of vaporization of sodium and the heat capacity of a saturated liquid are revealed. An analysis of the obtained results is presented using the methodology for analyzing the saturation curve of pure substances proposed in [3]. A comparison with known models of the sodium saturation curve is made, in particular, [4].

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